Attachment 2

Vermont Yankee Nuclear Power Station

Proposed Technical Specification Change No. 263 – Supplement No. 9

Extended Power Uprate

Revised Containment Overpressure Envelope

VYC-0808, Revision 6, CCN 06

Total number of pages in Attachment 2 (excluding this cover sheet) is 22.

MINOR CALCULATION CHANGE FORM (Tracked via DRN in MERLIN)

Calculation No.: VYC-0808	
Calculation Title: Core Spray and Residual Heat Removal Pump Net Positive Suction Head Margin Following a Loss of Coolant Accident or Anticipated Transient Without Scram	**Revision:** 6
MERLIN DRN No. or Minor Calculation Change No.: 06	**Indicate Status of Minor Calculation Change:** – Prel; (– Pend;) – As-Built
Modification No./Task No./ER No. VYDC-2003-008 .	
Computer Code Used ☐ Yes ☒ No. **If "Yes", Code:**	

1 Purpose of Change:	Incorporate GE-VYNPS-AEP-346R1
2 SSC affected:	See attached VYAPF0017.07
3 Design Input Documents not used in parent Calculation:	See attached VYAPF0017.07
4 Drawings/Procedures/ Calculations / other Documents affected	See attached VYAPF0017.07
5 Description of Change:	See attached description
6 Impact on existing calculation conclusion:	Revised containment overpressure envelope for long term LOCA using 100% Spray Efficiency
7 Impact on DBD's, UFSAR, Technical Specifications:	See attached VYAPF0017.07

8. The existing calculation does/does not (circle one) have a calculation verification checklist. (See Remarks)

Remarks: This ENN-DC-126 MCC is to a VY design verified calculation prepared under AP-0017. AP-0017 did not have a "checklist", instead design verification was documented on form VYAPF0017.04

NOTE:
A. If UFSAR or Technical Specifications need to be revised, Minor Calculation Change Form should not be used unless it is an editorial change to the UFSAR or Technical Specifications.
B. Minor Calculation Change Forms do not change the status of the Parent Calculation Revision.

	Print/Sign		
Prepared by:	E. P. O'Brien		**Date:** 7/16/04
Reviewed by: *	E.G. Lind		**Date:** 7/16/04
Approved by	D.E. Yasi		**Date:** 7/20/04

* Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.

This IS a Quality Record -

5. Description of Change

The NPSH evaluation of the RHR and CS pumps is performed, using the same methodology as CCN04 (Ref. 11) for short term DBA-Loss of Coolant Accident (LOCA) case and CCN05 (Ref. 12) for long term DBA-Loss of Coolant Accident (LOCA) case. This CCN uses the EPU suppression pool temperature/pressure data supplied in Reference 1. Note – all References contained in AP0017.07 (Attachment B)

Reason for Change:
This CCN provides additional results regarding the Residual Heat Removal (RHR) and Core Spray (CS) Pump NPSH resulting from the Extended Power Uprate (EPU), which was initially evaluated in CCN04 and subsequently in CCN05.

Specifically, this CCN06 updates the short-term and long-term post LOCA results based on revised containment temperature and pressure profiles provided in Reference 1. The revised containment profiles reflect that the Containment Spray Thermal Mixing Efficiency used to develop the Reference 1 input was increased to 100%. This increase in spray efficiency resulted in a slight reduction to the pressure profile. The containment spray thermal mixing efficiency utilized in CCN 5 was based on the containment air to steam mass ratio.

CCN06 remains based upon: (1) The long-term post LOCA time of 200,000 seconds, beyond which overpressure is no longer being required, and (2) the containment leakage of 1.5 weight percent per day, to reflect the recently submitted Alternate Source Term (AST) License Amendment Request (Ref: 5, ERC-2004-024)

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Note: Figure 4.1 is not contained in this CCN.

TOTAL PAGES: 22

1.0 Objective

The objective of this CCN is to update the CCN05 (Ref. 12) post LOCA Extended Power Uprate (EPU) evaluation of the adequacy of the available NPSH for the Residual Heat Removal (RHR) and Core Spray (CS) pumps. This includes identification of any change in the amount and duration of suppression pool (torus) overpressure required to maintain adequate NPSH.

Specifically, this CCN06 updates the post LOCA results based on revised containment temperature and pressure profiles provided in Reference 1. The revised containment profiles reflect that the Spray Efficiency used to develop the Reference 1 input is 100%, which resulted in a slight reduction to the pressure profile from CCN05.Additionally, Reference 1 provided revised short-term LOCA data. Therefore, Section 4.1 of CCN04 to VYC-0808 Rev 6 (Ref. 11) is updated to include this data, though the results will be shown to remain unchanged.

2.0 Methodology

General

The methodology for determining the NPSH available (NPSHa) for a given event and temperature is the same as that developed in VYC-0808 Rev 6 and presented in Table 1 of that calculation (Ref: 4). The NPSH required (NPSHr) is also per VYC-0808 Rev 6 and is discussed in detail in Section 4.0 of this CCN. The methodology for determining the pump suction strainer head loss during a LOCA, and the time dependent profile for required overpressure is the same as that developed in CCN04.

3.0 Assumptions

1. None made

4.0 Analysis

As stated in Section 2.0, the methodology for determining the NPSHa is the same as that developed in VYC-0808 Rev 6 and presented in Table 1 of that calculation (Ref: 4). The following terms are used in the evaluation.

NPSHa (ft) = net positive suction head available without overpressure credit
(14.7-Pg)(144vf)+Z-hf-hs-hd

where:

Z (ft) = suction elevation head

hf (ft) = suction line losses

hs (ft) = clean strainer losses

hd (ft) = strainer debris losses

Pg (psia) = vapor pressure @ torus temperature

vf (ft^3/lb) = specific volume @ torus temperature and pressure

Pg and vf are obtained from ASME Steam Tables 1967 Formulation (Ref: 7)

NPSHr (ft) = net positive suction head required.
It should be noted that the NPSH required data provided by the pump vendor, as documented in Figures 2.1-1 and 2.2-1 of Attachment 3 to calculation VYC-0808, is actually *Allowable Operating Periods @ NPSHa Specified.* Allowable hours of operation at specified NPSHa values are identified for a range of flows. For this CCN, the NPSHa specified in these Figures is taken as the NPSHr at a given operating time.

Q (gpm) = pump flow rate

OPR (psig) = Overpressure Required
(NPSHr – NPSHa)/(144*Vf)
For those profile points where there is inadequate NPSH, when considering the suppression pool pressure to be atmospheric (14.7 psia), OPR is the amount of suppression pool pressure required to make NPSHa (ft) equal to NPSHr (ft).

OPA (psig)– Overpressure Available
The suppression pool pressure available, above atmospheric, for a given event and time.

OPC (psig)– Overpressure Credit Taken
The overpressure credited in the evaluation of NPSH. Engineering judgement is used to select the credit to be greater than the OPR, by a reasonable amount, and less than the OPA.

Detailed discussion of the above terms is provided in the subsections that follow.

4.1 LOCA – Short Term

The temperature and pressure (T/P) profile for the suppression pool during a LOCA is developed in GE-VYNPS-AEP-346R1 (Ref: 1). The short term data is provided from 0-600 seconds.

The evaluation of NPSH is documented in Table 4.1 using the peak pool temperature of 165.1°F which occurs at 600 seconds with a corresponding pool pressure of 17.64 psia. The peak temperature results in the largest vapor pressure and lowest NPSHa. Note that the temperature at lowest pool pressure is 161.2°F / 17.40psia. At this temperature the gain in vapor pressure more than offsets the reduction in pool pressure, therefore the 165.1°F case governs. The details of the evaluation are presented at the top of the Table followed by a matrix of the NPSH results for CS and RHR. Further discussion of selected terms is presented below.

Suction Elevation Head, Z

The values of Z for RHR and CS (12.30' and 12.47'respectively) as calculated in Section 3.5 of VYC-0808 are conservatively used in this evaluation. The suction elevation head is based on the water elevation in the torus. The EPU suppression pool water volume is slightly larger than the existing value used in VYC-0808, which would result in a slight increase in water elevation, and therefore Z.

A water volume comparison at maximum pool temperature is provided below:

	Pre-EPU	EPU
Ref:	(VYC-0808 Rev 6 Section 3.5)	(GE-VYNPS-AEP-346R1)
Short Term	76,800 cuft	79,390 cuft

Maximum Debris Losses (hd)

1 RHR: CCN #3 (Ref: 3) calculated the limiting head loss as 0.24 ft at 181.7°F and 7400 gpm. Note that this is a slight reduction from the head loss (0.33 ft) addressed in Section 3.2 of VYC-0808 Rev 6 (Ref: 4). For conservatism, 0.33 ft at 173°F is used. (Case 1 of Tables 2 and 8 of Ref: 2).

2 RHR: The head loss is taken as .48 ft (Ref: 4) at 170°F (Case 2b of Tables 2 and 8 of Ref: 2) and 14200 gpm.

CS The head loss is conservatively taken as .32 ft (Ref: 4) at 173°F (Case 3d of Tables 2 and 8 of Ref: 2) and 4600 gpm.

Refer to Section 2.0 of CCN04 (Ref. 11) for application of head loss at temperatures other than those used in its calculation.

NPRHr - CS
Figure 2.2-1 of Attachment 3 to calculation VYC-0808 provides a plot of *Allowable Operating Periods @ NPSHa Specified* values for various flow rates. This plot shows that at 4600 gpm an allowable NPSH of 28.0 ft is acceptable between 0 and 7 hrs of operation.

NPRHr - 1 RHR
Figure 2.1-1 of Attachment 3 to calculation VYC-0808 provides a plot of *Allowable Operating Periods @ NPSHa Specified* values for various flow rates. This plot shows that at 7400 gpm an allowable NPSH of 23.8 ft is acceptable between 0 and 7 hrs of operation.

NPRHr - 2 RHR
With two RHR pumps operating at a total flow of 14,200 gpm this yields a flow of 7100 gpm per pump.
Also per Figure 2.1-1, the plot shows that at between 0 and 7 hrs of operation, an allowable NPSH of 23.5 ft is acceptable at 7000 gpm and 24.0 ft is acceptable at 7600 gpm.

Interpolating between plotted NPSH values of 23.5 ft @ 7000 gpm and 24.0 ft @ 7600 gpm yields 23.6 ft @ 7100 gpm.

The interpolation equation is developed as documented Section 2.2.2 of VYC-0808 Rev 6 and is 23.0+(Q-6400)/1200

4.1.1 Evaluation
As can been seen from Table 4.1, there is adequate NPSHa and overpressure is not required.

4.2 LOCA – Long Term

The temperature and pressure (T/P) profile for the suppression pool during a LOCA is developed in GE-VYNPS-AEP-346R1 (Ref: 1). The long term data is provided from 0-864,000 seconds.

The evaluation of NPSH is documented in Table 4.2 using selected T/P points representing the long term profile of the suppression pool. The details of the evaluation are presented at the top of the Table followed by a matrix of the NPSH results for the T/P profile of CS and RHR. The evaluated long term flow rates of 7400 gpm (RHR) and 3500 gpm (CS) are consistent with calculation VYC-0808 Rev 6 (Ref: 4). Further discussion of selected terms is presented below.

Suction Elevation Head, Z
The values of Z for RHR and CS (12.40' and 12.57' respectively) as calculated in Section 3.5 of VYC-0808 are conservatively used in the evaluation. The suction elevation head is based on the water elevation in the torus. The EPU suppression pool water volume is slightly larger than the existing value used in VYC-0808, which would result in a slight increase in water elevation, and therefore Z.

A water volume comparison at maximum pool temperature is provided below:

	Pre-EPU	EPU
Ref:	(VYC-0808 Rev 6 Section 3.5)	(GE-VYNPS-AEP-346R1)
Long term	77,640 cuft	79,540 cuft

Maximum Debris Losses (hd)

1 RHR: CCN #3 (Ref: 3) calculated the limiting head loss as 0.24 ft at 181.7°F and 7400 gpm. Note that this is a slight reduction from the head loss (0.33 ft) addressed in Section 3.2 of VYC-0808 Rev 6 (Ref: 4). For conservatism, 0.33 ft at 173°F is used. (Case 1 of Tables 2 and 8 of Ref: 2).

CS: Note that CCN #3 (Ref: 3) documents the up-to-date limiting head loss as 0.19 ft at 181.7°F and 3500 gpm. This is a slight reduction from the head loss (0.21 ft) addressed in Section 3.2 of VYC-0808 Rev 6 (Ref: 4). For conservatism, 0.21 ft at 173°F is used. This is based on a conservative CS flow rate of 4000 gpm. (Case 3b of Tables 2 and 8 of Ref: 2).

NPRHr - CS

Figure 2.2-1 of Attachment 3 to calculation VYC-0808 provides a plot of *Allowable Operating Periods @ NPSHa Specified* values for various flow rates. This plot shows that at 3500 gpm the allowable NPSH increases between 7 and 20 hrs of operation and a value of 29.6 ft is acceptable beyond 20 hrs of operation. This maximum value is conservatively used for the entire long term period (>600 sec).

NPRHr - RHR

Figure 2.1-1 of Attachment 3 to calculation VYC-0808 provides a plot of *Allowable Operating Periods @ NPSHa Specified* values for various flow rates. This plot shows that at 7400 gpm the allowable NPSH increases between 7 and 100 hrs of operation and a value of 31.7 ft is acceptable beyond 100 hrs of operation. This maximum value is conservatively used for the entire long term period (>600 sec).

4.2.1 Evaluation

As can been seen from Figure 4.2 the overpressure required for RHR envelopes that required for CS and the overpressure varies continuously over time. In order to facilitate reporting and presentation of the overpressure required, an enveloping, stepped, overpressure credit is overlaid on Figure 4.2. Refer to Section 4.0 for discussion on selection of overpressure credit.

Though the long term flow rates are postulated at time 600 seconds (e.g. CS throttled down from 4600gpm to 3500gpm), it is not the intent of this calculation to imply at what time throttling should commence or how much throttling is required. This is a function of the time dependent NPSHr and pool temperature. This calculation conservatively evaluates the maximum NPSHr as occurring over the entire operating period (>600 sec). The actual NPSHr is lower between 0-7 hrs and increases after 7 hrs.

5.0 Summary of Results

NPSHa is rounded to the nearest 0.1ft and OPR, OPC, and OPA are rounded to the nearest 0.1psig.

5.1 LOCA - Short Term (0-600 sec):

NPSHa is adequate for both CS and RHR pumps without crediting overpressure. NPSHa shown below is at the peak temperature. The results remain unchanged from VYC-0808, Rev. 6, CCN04 (Ref. 11), Section 4.1, LOCA short-term results.

Pump	Total flow, gpm	NPSHr, ft	NPSHa, ft
CS	4,600	28.0	28.4
1RHR	7,400	23.8	31.1
2 RHR	14,200	23.6	28.8

5.2 LOCA - Long Term (>600 sec):

NPSHa is adequate for both CS and RHR pumps with an overpressure credit that varies over time, as shown in Fig. 4.2. NPSHa, OPR, OPC, OPA are shown below, at the peak temperature. The results remain unchanged from VYC-0808, Rev. 6, CCN05 (Ref. 12), LOCA long-term results, except for a slight reduction in Over Pressure Available (OPA).

Pump	Total flow, gpm	NPSHr, ft	NPSHa, ft	OPR, psig	OPC, psig	OPA, psig
CS	3,500	29.6	19.5	4.2	6.1	7.8
1RHR	7,400	31.7	19.6	5.1	6.1	7.8

6.0 Conclusions

Torus overpressure must be credited for 200,000 seconds for operating the RHR and CS pumps at EPU conditions for a long term DBA-Loss of Coolant Accident (LOCA) to achieve adequate NPSH available.

The results of this CCN will provide input to the PUSAR (Ref: 12) for the RHR and CS NPSH evaluation and will alter input to calculation VYC-1628 (Ref: 13) to address the need for crediting torus overpressure in the calculation of NPSH available. Note that calculation VYC-1628 may be superseded by GE EPU Analysis. The need for crediting torus overpressure in the RHR and CS NPSH evaluation, shall also be addressed in the SADBD (Ref: 14), UFSAR (Ref: 15), and system DBDs RHR (Ref: 16) and CS (Ref: 17).

Note that the changes to the UFSAR were originally proposed in CCN04 and CCN05 and are pending incorporation via the design change and licensing processes. This MCC simply updates the previous CCN04 and CCN05 performed under AP-0017. The UFSAR does not currently contain information on containment overpressure.

Note that use of overpressure credit must be approved by the NRC as part of EPU.

No specific 50.59 Screening/Evaluation is required for this CCN since all EPU design changes and associated 50.59 documentation will be part of VYDC-2003-008.

Table 4.1 LOCA – Short Term (1.5 wt. % Containment Leakage & 100% Spray Efficiency)

LOCA - Short Term

NPSHa = (14.7-Pg)(144Vf)+Z-hf-hs-hd
OPR = (NPSHr – NPSHa)/(144*Vf)
OPA = Over pressure available
OPC = Over pressure credited

Cross references:
Section 2.3 of VYC-0808 Rev 6 (Ref: 4)
See Discussion in Section 4.0 of this CCN

Short Term Flow Rate (gpm)

1 RHR	Q = 7400	CS	Q = 4600	Table of 1 calc VYC-0808 Rev 6 (Ref: 4)
2 RHR	Q = 14200			

Suction Line Losses (ft)

1 RHR	hf = 4.77E-8*Q^2	CS	hf = 2.5E-7*Q^2	Section 3.7 of VYC-0808 Rev 6 (Ref: 4)
2 RHR	hf = 7.84E-8*(Q/2)^2			

Clean Strainer Losses (ft)

1 RHR	hs = 0.33	CS	hs = 0.51	Section 3.6 of VYC-0808 Rev 6 (Ref: 4)
2 RHR	hs = 1.22			

Maximum Debris Losses (ft) @ >=base temperature — See discussion in Section 4.1 of this CCN

1 RHR	hd = 0.33@173F	CS	hd = 0.32@173F	Ref: 2, 3, 4
2 RHR	hd = 0.48@170F			Ref: 2, 4

Maximum Debris Losses (ft) @ < base temperature

1 RHR	hd = .33*(173/T)	CS	hd = .32*(173/T)	See discussion in Section 2.0 of CCN04 (Ref. 11)
2 RHR	hd = .48*(170/T)			

where T = suppression pool temperature, F

Elevation Head (ft)

RHR	Z = 12.3	CS	Z = 12.47	See discussion in Section 4.1 of this CCN for conservatism.

NPSHr (ft)

1 RHR	NPSHr = 23.8	CS	NPSHr = 28.0	See discussion in Section 4.1 of this CCN
2 RHR	NPSHr = 23.6			

Short Term (After EPU) - Peak Torus Temperature - 1.5 wt. % Containment Leakage & 100% Spray Efficiency

Pump(s)	Time (sec)	GE Pool Temp (F)	GE Pool Pressure psia	Pg (psia)	Vf (ft^3/lb)	Z (ft)	hf (ft)	hs (ft)	hd (ft)	NPSHa (ft)	NPSHr (ft)	OPR (psig)	OPA (psig)	OPC (psig)
CS	600	165.1	17.64	5.349	0.016423	12.47	5.29	0.51	0.34	28.44	28.00	0.00	2.94	0.00
1 RHR	600	165.1	17.64	5.349	0.016423	12.30	2.61	0.33	0.35	31.12	23.80	0.00	2.94	0.00
2 RHR	600	165.1	17.64	5.349	0.016423	12.30	3.95	1.22	0.49	28.75	23.60	0.00	2.94	0.00

Table 4.2 LOCA – Long Term (1.5 wt. % Containment Leakage & 100% Spray Efficiency)

LOCA - Long Term

NPSHa = (14.7-Pg)(144Vf)+Z-hf-hs-hd
OPR = Over pressure required (NPSHr – NPSHa)/(144*Vf)
OPA = Over pressure available
OPC = Over pressure credited

Cross references:
Section 2.3 of VYC-0808 Rev 6 (Ref: 4)
See Discussion in Section 4.0 of this CCN

Long Term Flow Rate (gpm)				
1 RHR	Q = 7400	CS	Q = 3500	Table of 1 calc VYC-0808 Rev 6 (Ref: 4)
Suction Line Losses (ft)				
1 RHR	hf = 4.77E-8*Q^2	CS	hf = 2.5E-7*Q^2	Section 3.7 of VYC-0808 Rev 6 (Ref: 4)
Clean Strainer Losses (ft)				
1 RHR	hs = 0.33	CS	hs = .38*(Q/4000)^2 for Q<= 4000	Section 3.6 of VYC-0808 Rev 6 (Ref: 4)
Maximum Debris Losses (ft) @ >= 173F				
1 RHR	hd = 0.33	CS	hd = 0.21	See discussion in Section 4.2 of this CCN
Maximum Debris Losses (ft) @ < 173F				
1 RHR	hd = .33*(173/T)	CS	hd = .21*(173/T)	See discussion in Section 2.0 of CCN04 (Ref. 11)
where T = suppression pool temperature, F				
Elevation Head (ft)				
RHR	Z = 12.4	CS	Z = 12.57	See discussion in Section 4.2 of this CCN for conservatism.
NPSHr (ft)				
1 RHR	NPSHr = 31.7	CS	NPSHr = 29.6	See discussion in Section 4.2 of this CCN

Table 4.2 LOCA – Long Term (1.5 wt. % Containment Leakage & 100% Spray Efficiency)

CS - Long Term (After EPU) 1.5 wt. % Containment Leakage & 100% Spray Efficiency

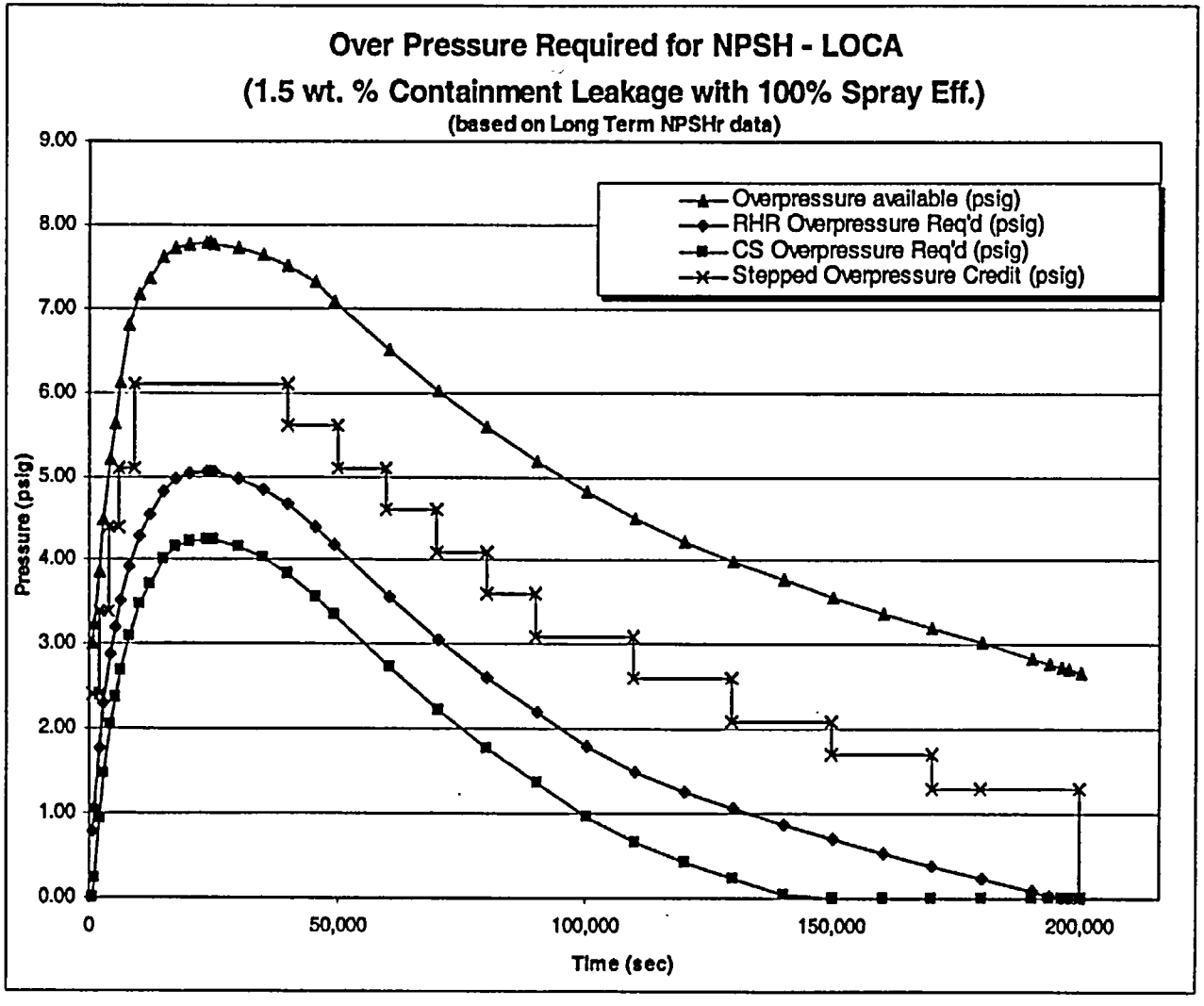
Time (sec)	GE Pool Temp (F)	GE Pool Pressure psia	Pg (psia)	Vf (ft^3/lb)	Z (ft)	hf (ft)	hs (ft)	hd (ft)	CS NPSHa (ft)	CS NPSHr (ft)	CS OPR (psig)	OPA (psig)	OPC (psig)
786	169.7	17.71	5.951	0.016449	12.57	3.06	0.29	0.21	29.73	29.60	0.00	3.01	2.40
1,098	171.8	17.94	6.245	0.016461	12.57	3.06	0.29	0.21	29.05	29.60	0.23	3.24	2.40
2,033	176.6	18.57	6.962	0.016489	12.57	3.06	0.29	0.21	27.38	29.60	0.94	3.87	3.40
2,962	180.0	19.17	7.511	0.016509	12.57	3.06	0.29	0.21	26.10	29.60	1.47	4.47	3.40
4,196	183.4	19.90	8.096	0.016530	12.57	3.06	0.29	0.21	24.73	29.60	2.05	5.20	4.40
5,125	185.2	20.34	8.420	0.016541	12.57	3.06	0.29	0.21	23.96	29.60	2.37	5.64	4.40
6,275	187.0	20.82	8.756	0.016552	12.57	3.06	0.29	0.21	23.17	29.60	2.70	6.12	5.10
8,036	189.1	21.50	9.161	0.016566	12.57	3.06	0.29	0.21	22.22	29.60	3.09	6.80	5.10
10,220	191.0	21.86	9.541	0.016578	12.57	3.06	0.29	0.21	21.32	29.60	3.47	7.16	6.10
12,094	192.2	22.06	9.788	0.016585	12.57	3.06	0.29	0.21	20.74	29.60	3.71	7.36	6.10
15,170	193.6	22.31	10.083	0.016594	12.57	3.06	0.29	0.21	20.04	29.60	4.00	7.61	6.10
17,669	194.3	22.43	10.233	0.016599	12.57	3.06	0.29	0.21	19.68	29.60	4.15	7.73	6.10
20,156	194.6	22.46	10.298	0.016601	12.57	3.06	0.29	0.21	19.53	29.60	4.21	7.76	6.10
23,812	194.7	22.48	10.320	0.016601	12.57	3.06	0.29	0.21	19.48	29.60	4.23	7.78	6.10
24,495	194.7	22.48	10.320	0.016601	12.57	3.06	0.29	0.21	19.48	29.60	4.23	7.78	6.10
25,120	194.7	22.47	10.320	0.016601	12.57	3.06	0.29	0.21	19.48	29.60	4.23	7.77	6.10
30,095	194.3	22.42	10.233	0.016599	12.57	3.06	0.29	0.21	19.68	29.60	4.15	7.72	6.10
35,065	193.7	22.33	10.104	0.016595	12.57	3.06	0.29	0.21	19.99	29.60	4.02	7.63	6.10
40,020	192.8	22.20	9.914	0.016589	12.57	3.06	0.29	0.21	20.44	29.60	3.83	7.50	5.60
45,637	191.5	22.01	9.644	0.016581	12.57	3.06	0.29	0.21	21.08	29.60	3.57	7.31	5.60
49,406	190.4	21.78	9.420	0.016574	12.57	3.06	0.29	0.21	21.61	29.60	3.35	7.08	5.60
60,551	187.2	21.21	8.794	0.016554	12.57	3.06	0.29	0.21	23.09	29.60	2.73	6.51	4.60
70,342	184.4	20.72	8.275	0.016536	12.57	3.06	0.29	0.21	24.31	29.60	2.22	6.02	4.10
80,342	181.8	20.28	7.816	0.016520	12.57	3.06	0.29	0.21	25.38	29.60	1.77	5.58	3.60
90,340	179.3	19.89	7.395	0.016505	12.57	3.06	0.29	0.21	26.37	29.60	1.36	5.19	3.10
100,340	176.8	19.52	6.994	0.016490	12.57	3.06	0.29	0.21	27.30	29.60	0.97	4.82	3.10
110,340	174.8	19.20	6.686	0.016478	12.57	3.06	0.29	0.21	28.02	29.60	0.68	4.50	2.60
120,306	173.2	18.93	6.447	0.016469	12.57	3.06	0.29	0.21	28.58	29.60	0.43	4.23	2.60
130,302	171.8	18.69	6.245	0.016461	12.57	3.06	0.29	0.21	29.05	29.60	0.23	3.99	2.10
140,302	170.4	18.47	6.048	0.016453	12.57	3.06	0.29	0.21	29.51	29.60	0.04	3.77	2.10
150,302	169.1	18.27	5.870	0.016445	12.57	3.06	0.29	0.21	29.92	29.60	0.00	3.57	1.70
160,302	167.8	18.07	5.696	0.016438	12.57	3.06	0.29	0.22	30.31	29.60	0.00	3.37	1.70
170,302	166.6	17.90	5.539	0.016431	12.57	3.06	0.29	0.22	30.67	29.60	0.00	3.20	1.30
180,302	165.3	17.72	5.374	0.016424	12.57	3.06	0.29	0.22	31.05	29.60	0.00	3.02	1.30
190,302	164.1	17.54	5.225	0.016417	12.57	3.06	0.29	0.22	31.40	29.60	0.00	2.84	1.30
194,052	163.6	17.47	5.164	0.016414	12.57	3.06	0.29	0.22	31.54	29.60	0.00	2.77	1.30
196,552	163.3	17.43	5.127	0.016413	12.57	3.06	0.29	0.22	31.62	29.60	0.00	2.73	1.30
197,802	163.2	17.41	5.115	0.016412	12.57	3.06	0.29	0.22	31.65	29.60	0.00	2.71	1.30
200,302	162.9	17.37	5.079	0.016411	12.57	3.06	0.29	0.22	31.73	29.60	0.00	2.67	0.00

Table 4.2 - LOCA – Long Term (1.5 wt. % Containment Leakage & 100% Spray Efficiency)

RHR - Long Term (After EPU) 1.5 wt. % Containment Leakage & 100% Spray Efficiency

Time (sec)	GE Pool Temp (F)	GE Pool Pressure psia	Pg (psia)	Vf (ft^3/lb)	Z (ft)	hf (ft)	hs (ft)	hd (ft)	RHR NPSHa (ft)	RHR NPSHr (ft)	RHR OPR (psig)	OPA (psig)	OPC (psig)
786	169.7	17.71	5.951	0.016449	12.40	2.61	0.33	0.34	29.84	31.70	0.78	3.01	2.40
1,098	171.8	17.94	6.245	0.016461	12.40	2.61	0.33	0.33	29.17	31.70	1.07	3.24	2.40
2,033	176.6	18.57	6.962	0.016489	12.40	2.61	0.33	0.33	27.50	31.70	1.77	3.87	3.40
2,962	180.0	19.17	7.511	0.016509	12.40	2.61	0.33	0.33	26.22	31.70	2.31	4.47	3.40
4,196	183.4	19.90	8.096	0.016530	12.40	2.61	0.33	0.33	24.85	31.70	2.88	5.20	4.40
5,125	185.2	20.34	8.420	0.016541	12.40	2.61	0.33	0.33	24.09	31.70	3.20	5.64	4.40
6,275	187.0	20.82	8.756	0.016552	12.40	2.61	0.33	0.33	23.30	31.70	3.53	6.12	5.10
8,036	189.1	21.50	9.161	0.016566	12.40	2.61	0.33	0.33	22.34	31.70	3.92	6.80	5.10
10,220	191.0	21.86	9.541	0.016578	12.40	2.61	0.33	0.33	21.44	31.70	4.30	7.16	6.10
12,094	192.2	22.06	9.788	0.016585	12.40	2.61	0.33	0.33	20.86	31.70	4.54	7.36	6.10
15,170	193.6	22.31	10.083	0.016594	12.40	2.61	0.33	0.33	20.16	31.70	4.83	7.61	6.10
17,669	194.3	22.43	10.233	0.016599	12.40	2.61	0.33	0.33	19.81	31.70	4.98	7.73	6.10
20,156	194.6	22.46	10.298	0.016601	12.40	2.61	0.33	0.33	19.65	31.70	5.04	7.76	6.10
23,812	194.7	22.48	10.320	0.016601	12.40	2.61	0.33	0.33	19.60	31.70	5.06	7.78	6.10
24,495	194.7	22.48	10.320	0.016601	12.40	2.61	0.33	0.33	19.60	31.70	5.06	7.78	6.10
25,120	194.7	22.47	10.320	0.016601	12.40	2.61	0.33	0.33	19.60	31.70	5.06	7.77	6.10
30,095	194.3	22.42	10.233	0.016599	12.40	2.61	0.33	0.33	19.81	31.70	4.98	7.72	6.10
35,065	193.7	22.33	10.104	0.016595	12.40	2.61	0.33	0.33	20.11	31.70	4.85	7.63	6.10
40,020	192.8	22.20	9.914	0.016589	12.40	2.61	0.33	0.33	20.56	31.70	4.66	7.50	5.60
45,637	191.5	22.01	9.644	0.016581	12.40	2.61	0.33	0.33	21.20	31.70	4.40	7.31	5.60
49,406	190.4	21.78	9.420	0.016574	12.40	2.61	0.33	0.33	21.73	31.70	4.18	7.08	5.60
60,551	187.2	21.21	8.794	0.016554	12.40	2.61	0.33	0.33	23.21	31.70	3.56	6.51	4.60
70,342	184.4	20.72	8.275	0.016536	12.40	2.61	0.33	0.33	24.43	31.70	3.05	6.02	4.10
80,342	181.8	20.28	7.816	0.016520	12.40	2.61	0.33	0.33	25.50	31.70	2.60	5.58	3.60
90,340	179.3	19.89	7.395	0.016505	12.40	2.61	0.33	0.33	26.49	31.70	2.19	5.19	3.10
100,340	176.8	19.52	6.994	0.016490	12.40	2.61	0.33	0.33	27.43	31.70	1.80	4.82	3.10
110,340	174.8	19.20	6.686	0.016478	12.40	2.61	0.33	0.33	28.14	31.70	1.50	4.50	2.60
120,306	173.2	18.93	6.447	0.016469	12.40	2.61	0.33	0.33	28.70	31.70	1.26	4.23	2.60
130,302	171.8	18.69	6.245	0.016461	12.40	2.61	0.33	0.33	29.17	31.70	1.07	3.99	2.10
140,302	170.4	18.47	6.048	0.016453	12.40	2.61	0.33	0.34	29.62	31.70	0.88	3.77	2.10
150,302	169.1	18.27	5.870	0.016445	12.40	2.61	0.33	0.34	30.03	31.70	0.71	3.57	1.70
160,302	167.8	18.07	5.696	0.016438	12.40	2.61	0.33	0.34	30.43	31.70	0.54	3.37	1.70
170,302	166.6	17.90	5.539	0.016431	12.40	2.61	0.33	0.34	30.79	31.70	0.38	3.20	1.30
180,302	165.3	17.72	5.374	0.016424	12.40	2.61	0.33	0.35	31.16	31.70	0.23	3.02	1.30
190,302	164.1	17.54	5.225	0.016417	12.40	2.61	0.33	0.35	31.51	31.70	0.08	2.84	1.30
194,052	163.6	17.47	5.164	0.016414	12.40	2.61	0.33	0.35	31.65	31.70	0.02	2.77	1.30
196,552	163.3	17.43	5.127	0.016413	12.40	2.61	0.33	0.35	31.73	31.70	0.00	2.73	1.30
197,802	163.2	17.41	5.115	0.016412	12.40	2.61	0.33	0.35	31.76	31.70	0.00	2.71	1.30
200,302	162.9	17.37	5.079	0.016411	12.40	2.61	0.33	0.35	31.84	31.70	0.00	2.67	0.00

Figure 4.2 LOCA – Long Term (1.5 wt. % Containment Leakage & 100% Spray Efficiency)



OPC overpress credit	
(sec)	(psig)
601	2.4
2000	2.4
2001	3.4
4000	3.4
4001	4.4
6000	4.4
6001	5.1
9000	5.1
9001	6.1
40000	6.1
40001	5.6
50000	5.6
50001	5.1
60000	5.1
60001	4.6
70000	4.6
70001	4.1
80000	4.1
80001	3.6
90000	3.6
90001	3.1
110000	3.1
110001	2.6
130000	2.6
130001	2.1
150000	2.1
150001	1.7
170000	1.7
170001	1.3
180000	1.3
200000	1.3
200001	0

Excel Verification Sample Calculation

Table 4.1 CS Verification (Line 40):

Cell G40 = $F$30
= 12.47

Cell H40 = 0.00000025*$F$9^2
= 0.00000025*4600^2
= 5.29

Cell I40 = $F$17
= 0.51

Cell J40 = ROUND(IF(C40<173,0.32*(173/C40),0.32),2)
= 165.1<173 = True
= 0.32*(173/C40)
= 0.32*(173/165.1)
= 0.34

Cell K40 =+((14.7-E40)*144*F40)+G40-H40-I40-J40
= ((14.7-5.349)*144*0.016423)+12.47-5.29-0.51-0.34
= 28.44

Cell L40 = $F$33
= 28.00

Cell M40 =IF((+L40-K40)/(144*F40)>0,(+L40-K40)/(144*F40),0)
=(28.00-28.44)/(144*0.016423) = -0.186<0, False
= 0

Cell N40 = +D40-14.7
= 17.64-14.7
= 2.94

Table 4.2 CS Table Verification (Line 50):

Cell F50 = $F$25
= 12.57

Cell G50 = 0.00000025*$F$9^2
= 0.00000025*3500^2
= 3.06

Cell H50 = 0.38*(($F$9/4000)^2)
= 0.38*((3500/4000)^2)
= 0.29

Cell I50 = ROUND(IF(B50<173,$F$18*(173/B50),$F$18),2)
194.3<173 = False (For True outcome see below, Cell I72)
= $F$18
= 0.21

Cell I72 = ROUND(IF(B72<173,$F$18*(173/B72),$F$18),2)
= 162.9<173 = True
= $F$18*(173/B72)
= 0.21*(173/162.9)
= 0.22

Cell J50 = +((14.7-D50)*144*E50)+F50-G50-H50-I50
= ((14.7-10.233)*144*0.016599)+12.57-3.06-0.29-0.21
= 19.687 [Worksheet shows 19.68 - Check OK - difference attributed to significant figures used in hand calc vs Excel]

Cell K50 = $F$28
= 29.6

Cell L50 = IF((+K50-J50)/(144*E50)>0,(+K50-J50)/(144*E50),0)
(29.6-19.68)/(144*0.016599) = 4.15>0 True (For False outcome see below, Cell L34)
= 4.15

Cell L34 = IF((+K34-J34)/(144*E34)>0,(+K34-J34)/(144*E34),0)
= (29.6-29.73)/(144*0.016449) = -0.055>0 False
= 0

Cell M50 = +C50-14.7
= 22.42-14.7
= 7.72

Table 4.2 RHR Table Verification (Line 78):

Cell F78 = $C$25
= 12.40

Cell G78 = 0.0000000477*$C$9^2
= 0.0000000477*7400^2
= 2.61

Cell H78 = $C$15
= 0.33

Cell I78 = ROUND(IF(B78<173,$C$18*(173/B78),$C$18),2)
169.7<173 = True (For False outcome see below, Cell I81)
= $C$18*(173/B78)
= 0.33*(173/169.7)
= 0.34

Cell I81 = ROUND(IF(B81<173,$C$18*(173/B81),$C$18),2)
180<173 = False
= $C$18
= 0.33

Cell J78 = +((14.7-D78)*144*E78)+F78-G78-H78-I78
= ((14.7-5.951)*144*0.016449)+12.40-2.61-0.33-0.34
= 29.84

Cell K78 = $C$28
= 31.7

Cell L78 = IF((+K78-J78)/(144*E78)>0,(+K78-J78)/(144*E78),0)
(31.7-29.84)/(144*0.016449)=0.785>0 True (For False outcome see below, Cell L116)
= 0.785 [Worksheet shows 0.78 - Check OK - difference attributed to significant figures used in hand calc vs Excel]

Cell L116 = IF((+K116-J116)/(144*E116)>0,(+K116-J116)/(144*E116),0)
= (31.7-31.84)/(144*0.016411) = -0.059>0 False
= 0

Cell M78 = +C78-14.7
= 17.71-14.7
= 3.01

	A	B	C	D	E	F	G	H
1	LOCA - Short Term							Cross references:
2	NPSHa =	(14.7-Pg)(144/Vf)+Z-hf-ho-hd						Section 2.2 of VYC-0808 Rev 6 (Ref. 4)
3	OPR =	(NPSHr - NPSHa)/(144*Vf)						See Discussion in Section 4.0 of this CCN
4	OPA =	Over pressure available						
5	OPC =	Over pressure credited						
6								
7								
8	Short Term Flow Rate (gpm)							
9	1 RHR	Q = 7400		CS	Q = 4600			Table of 1 cells VYC-0808 Rev 6 (Ref. 4)
10	2 RHR	Q = 14200						
11								
12	Suction Line Losses (ft)							
13	1 RHR	hf = 4.77E-8*Q^2		CS	hf = 2.9E-7*Q^2			Section 3.7 of VYC-0808 Rev 6 (Ref. 4)
14	2 RHR	hf = 7.84E-8*(Q/2)^2						
15								
16	Clean Strainer Losses (ft)							
17	1 RHR	ho = 0.33		CS	ho = 0.51			Section 3.6 of VYC-0808 Rev 6 (Ref. 4)
18	2 RHR	ho = 1.32						
19								
20	Maximum Debris Losses (ft) @ [illegible] temperature							See discussion in Section 4.1 of this CCN
21	1 RHR	hd = 0.35@173F		CS	hd = 0.32@173F			Ref. 2, 3, 4
22	2 RHR	hd = 0.48@170F						Ref. 2, 4
23								
24	Maximum Debris Losses (ft) @ ≤ base temperature							
25	1 RHR	hd = .33*(173/T)		CS	hd = .32*(173/T)			See discussion in Section 2.0 of CCN04 (Ref. 11)
26	2 RHR	hd = .48*(170/T)						
27	where T = suppression pool temperature, F							
28								
29	Elevation Head (ft)							
30	RHR	Z = 12.3		CS	Z = 12.47			See discussion in Section 4.1 of this CCN for conservatism
31								
32	NPSHr (ft)							
33	1 RHR	NPSHr = 23.8		CS	NPSHr = 26			See discussion in Section 4.1 of this CCN
34	2 RHR	NPSHr = 23.6						
35								
36	Short Term (After EPU) - Peak Torus Temperature - 1.5 wt. % Containment Leakage & 100% Spray Efficiency							

	Pump(s)	Time (sec)	GE Pool Temp (F)	GE Pool Pressure psia	Pg (psig)	Vf (ft^3/lb)	Z (ft)	hf (ft)	ho (ft)	hd (ft)	NPSHa (ft)	NPSHr (ft)	OPR (psig)	OPA (psig)	OPC (psig)
40	CS	600	165.1	17.64	2.940	0.016423	=$F$30	=0.00000029*$F$9^2	=$F$17	=ROUND(IF(C40<173,0.32*(173/C40),0.32),2)	=((14.7+E40)*144*F40)+G40-H40-I40-J40	=$F$33	=IF((L40-K40)/(144*F40)>0,(L40-K40)/(144*F40),0)	=D40-14.7	0
41	1 RHR	600	165.1	17.64	2.940	0.016423	=$C$30	=0.0000000477*$C$9^2	=$C$17	=ROUND(IF(C41<173,0.33*(173/C41),0.33),2)	=((14.7+E41)*144*F41)+G41-H41-I41-J41	=$C$33	=IF((L41-K41)/(144*F41)>0,(L41-K41)/(144*F41),0)	=D41-14.7	0
42	2 RHR	600	165.1	17.64	2.940	0.016423	=$C$30	=0.0000000784*($C$10/2)^2	=$C$18	=ROUND(IF(C42<170,0.48*(170/C42),0.48),2)	=((14.7+E42)*144*F42)+G42-H42-I42-J42	=$C$34	=IF((L42-K42)/(144*F42)>0,(L42-K42)/(144*F42),0)	=D42-14.7	0

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	LOCA - Long Term							Cross references:						
2	NPSHa =	(14.7-Pg)(144/Vf)+Z-hf-ho-hd						Section 2.3 of VYC-0808 Rev 6 (Ref. 4)						
3	OPR =	Over pressure required (NPSHr - NPSHa)/(144*Vf)						See Discussion in Section 4.6 of this CCN						
4	OPA =	Over pressure available												
5	OPC =	Over pressure credited												
6														
7														
8	Long Term Flow Rate (gpm)													
9	1 RHR	Q = 7400		CS		Q = 3500		Table of 1 calc VYC-0808 Rev 6 (Ref. 4)						
10														
11	Suction Line Losses (ft)													
12	1 RHR	hf = 4.77E-6*Q^2		CS		hf = 2.5E-7*Q^2		Section 2.7 of VYC-0808 Rev 6 (Ref. 4)						
13														
14	Clean Strainer Losses (ft)													
15	1 RHR	ho = 0.33		CS		ho = .38*(Q/4000)^2 for Q= 4000		Section 3.8 of VYC-0808 Rev 6 (Ref. 4)						
16														
17	Maximum Debris Losses (ft) @ >= 173F													
18	1 RHR	hd = 0.33		CS		hd = 0.21		See discussion in Section 4.2 of this CCN						
19														
20	Maximum Debris Losses (ft) @ < 173F													
21	1 RHR	hd = .33*(173/T)		CS		hd = .21*(173/T)		See discussion in Section 2.8 of CCN04 (Ref. 11)						
22	where T = suppression pool temperature, F													
23														
24	Elevation Head (ft)													
25	RHR	Z = 12.4		CS		Z = 12.87		See discussion in Section 4.2 of this CCN for conservatism.						
26														
27	NPSHr (ft)													
28	1 RHR	NPSHr = 31.7		CS		NPSHr = 29.8		See discussion in Section 4.2 of this CCN						
29														
30	CS - Long Term (After EPU) 1.5 wt. % Containment Leakage & 100% Spray Efficiency													
31-33	Time (sec)	GE Pool Temp (F)	GE Pool Pressure psia	Pg (psia)	Vf (ft^3/lb)	Z (ft)	hf (ft)	ho (ft)	hd (ft)	CS NPSHa (ft)	CS NPSHr (ft)	CS OPR (psig)	OPA (psig)	OPC (psig)
34	785.8045	168.7	17.71	5.961	0.016448	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B34<173,$F$18*(173/B34),$F$18),2)	=((14.7-D34)*144*E34)+F34-G34-H34-I34	=$F$28	=IF(((K34-J34)/(144*E34))>0,((K34-J34)/(144*E34)),0)	=C34-14.7	=VLOOKUP(A34,$G$122:$K$153,2)
35	1087.866	171.8	17.94	6.246	0.016461	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B35<173,$F$18*(173/B35),$F$18),2)	=((14.7-D35)*144*E35)+F35-G35-H35-I35	=$F$28	=IF(((K35-J35)/(144*E35))>0,((K35-J35)/(144*E35)),0)	=C35-14.7	=VLOOKUP(A35,$G$122:$K$153,2)
36	2033.366	176.8	18.57	6.962	0.016480	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B36<173,$F$18*(173/B36),$F$18),2)	=((14.7-D36)*144*E36)+F36-G36-H36-I36	=$F$28	=IF(((K36-J36)/(144*E36))>0,((K36-J36)/(144*E36)),0)	=C36-14.7	=VLOOKUP(A36,$G$122:$K$153,2)
37	2962.323	180	19.17	7.611	0.016508	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B37<173,$F$18*(173/B37),$F$18),2)	=((14.7-D37)*144*E37)+F37-G37-H37-I37	=$F$28	=IF(((K37-J37)/(144*E37))>0,((K37-J37)/(144*E37)),0)	=C37-14.7	=VLOOKUP(A37,$G$122:$K$153,2)
38	4186.48	183.4	19.9	8.096	0.01653	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B38<173,$F$18*(173/B38),$F$18),2)	=((14.7-D38)*144*E38)+F38-G38-H38-I38	=$F$28	=IF(((K38-J38)/(144*E38))>0,((K38-J38)/(144*E38)),0)	=C38-14.7	=VLOOKUP(A38,$G$122:$K$153,2)
39	6125.042	186.2	20.34	8.42	0.016541	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B39<173,$F$18*(173/B39),$F$18),2)	=((14.7-D39)*144*E39)+F39-G39-H39-I39	=$F$28	=IF(((K39-J39)/(144*E39))>0,((K39-J39)/(144*E39)),0)	=C39-14.7	=VLOOKUP(A39,$G$122:$K$153,2)
40	8275.282	187	20.82	8.756	0.016562	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B40<173,$F$18*(173/B40),$F$18),2)	=((14.7-D40)*144*E40)+F40-G40-H40-I40	=$F$28	=IF(((K40-J40)/(144*E40))>0,((K40-J40)/(144*E40)),0)	=C40-14.7	=VLOOKUP(A40,$G$122:$K$153,2)
41	8036.636	188.1	21.5	9.161	0.016566	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B41<173,$F$18*(173/B41),$F$18),2)	=((14.7-D41)*144*E41)+F41-G41-H41-I41	=$F$28	=IF(((K41-J41)/(144*E41))>0,((K41-J41)/(144*E41)),0)	=C41-14.7	=VLOOKUP(A41,$G$122:$K$153,2)
42	10219.80	191	21.86	9.541	0.016578	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B42<173,$F$18*(173/B42),$F$18),2)	=((14.7-D42)*144*E42)+F42-G42-H42-I42	=$F$28	=IF(((K42-J42)/(144*E42))>0,((K42-J42)/(144*E42)),0)	=C42-14.7	=VLOOKUP(A42,$G$122:$K$153,2)
43	12083.67	192.2	22.08	9.788	0.016585	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B43<173,$F$18*(173/B43),$F$18),2)	=((14.7-D43)*144*E43)+F43-G43-H43-I43	=$F$28	=IF(((K43-J43)/(144*E43))>0,((K43-J43)/(144*E43)),0)	=C43-14.7	=VLOOKUP(A43,$G$122:$K$153,2)
44	15189.8	193.6	22.31	10.083	0.016594	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B44<173,$F$18*(173/B44),$F$18),2)	=((14.7-D44)*144*E44)+F44-G44-H44-I44	=$F$28	=IF(((K44-J44)/(144*E44))>0,((K44-J44)/(144*E44)),0)	=C44-14.7	=VLOOKUP(A44,$G$122:$K$153,2)
45	17088.2	194.3	22.43	10.233	0.016599	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B45<173,$F$18*(173/B45),$F$18),2)	=((14.7-D45)*144*E45)+F45-G45-H45-I45	=$F$28	=IF(((K45-J45)/(144*E45))>0,((K45-J45)/(144*E45)),0)	=C45-14.7	=VLOOKUP(A45,$G$122:$K$153,2)
46	20158.36	194.6	22.46	10.299	0.016601	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B46<173,$F$18*(173/B46),$F$18),2)	=((14.7-D46)*144*E46)+F46-G46-H46-I46	=$F$28	=IF(((K46-J46)/(144*E46))>0,((K46-J46)/(144*E46)),0)	=C46-14.7	=VLOOKUP(A46,$G$122:$K$153,2)
47	23811.7	194.7	22.46	10.32	0.016601	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B47<173,$F$18*(173/B47),$F$18),2)	=((14.7-D47)*144*E47)+F47-G47-H47-I47	=$F$28	=IF(((K47-J47)/(144*E47))>0,((K47-J47)/(144*E47)),0)	=C47-14.7	=VLOOKUP(A47,$G$122:$K$153,2)
48	24484.86	194.7	22.46	10.32	0.016601	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B48<173,$F$18*(173/B48),$F$18),2)	=((14.7-D48)*144*E48)+F48-G48-H48-I48	=$F$28	=IF(((K48-J48)/(144*E48))>0,((K48-J48)/(144*E48)),0)	=C48-14.7	=VLOOKUP(A48,$G$122:$K$153,2)
49	25119.86	194.7	22.47	10.32	0.016601	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B49<173,$F$18*(173/B49),$F$18),2)	=((14.7-D49)*144*E49)+F49-G49-H49-I49	=$F$28	=IF(((K49-J49)/(144*E49))>0,((K49-J49)/(144*E49)),0)	=C49-14.7	=VLOOKUP(A49,$G$122:$K$153,2)
50	30084.64	194.3	22.42	10.233	0.016599	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B50<173,$F$18*(173/B50),$F$18),2)	=((14.7-D50)*144*E50)+F50-G50-H50-I50	=$F$28	=IF(((K50-J50)/(144*E50))>0,((K50-J50)/(144*E50)),0)	=C50-14.7	=VLOOKUP(A50,$G$122:$K$153,2)
51	36054.51	193.7	22.33	10.104	0.016595	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B51<173,$F$18*(173/B51),$F$18),2)	=((14.7-D51)*144*E51)+F51-G51-H51-I51	=$F$28	=IF(((K51-J51)/(144*E51))>0,((K51-J51)/(144*E51)),0)	=C51-14.7	=VLOOKUP(A51,$G$122:$K$153,2)
52	40020.36	192.8	22.2	9.914	0.016588	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B52<173,$F$18*(173/B52),$F$18),2)	=((14.7-D52)*144*E52)+F52-G52-H52-I52	=$F$28	=IF(((K52-J52)/(144*E52))>0,((K52-J52)/(144*E52)),0)	=C52-14.7	=VLOOKUP(A52,$G$122:$K$153,2)
53	45637.23	191.6	22.01	9.644	0.016581	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B53<173,$F$18*(173/B53),$F$18),2)	=((14.7-D53)*144*E53)+F53-G53-H53-I53	=$F$28	=IF(((K53-J53)/(144*E53))>0,((K53-J53)/(144*E53)),0)	=C53-14.7	=VLOOKUP(A53,$G$122:$K$153,2)
54	49408.11	190.4	21.78	9.42	0.016574	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B54<173,$F$18*(173/B54),$F$18),2)	=((14.7-D54)*144*E54)+F54-G54-H54-I54	=$F$28	=IF(((K54-J54)/(144*E54))>0,((K54-J54)/(144*E54)),0)	=C54-14.7	=VLOOKUP(A54,$G$122:$K$153,2)
55	60660.64	187.2	21.21	8.794	0.016564	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B55<173,$F$18*(173/B55),$F$18),2)	=((14.7-D55)*144*E55)+F55-G55-H55-I55	=$F$28	=IF(((K55-J55)/(144*E55))>0,((K55-J55)/(144*E55)),0)	=C55-14.7	=VLOOKUP(A55,$G$122:$K$153,2)
56	70042.20	184.4	20.72	8.273	0.016536	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B56<173,$F$18*(173/B56),$F$18),2)	=((14.7-D56)*144*E56)+F56-G56-H56-I56	=$F$28	=IF(((K56-J56)/(144*E56))>0,((K56-J56)/(144*E56)),0)	=C56-14.7	=VLOOKUP(A56,$G$122:$K$153,2)
57	80042.20	181.8	20.26	7.816	0.01652	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B57<173,$F$18*(173/B57),$F$18),2)	=((14.7-D57)*144*E57)+F57-G57-H57-I57	=$F$28	=IF(((K57-J57)/(144*E57))>0,((K57-J57)/(144*E57)),0)	=C57-14.7	=VLOOKUP(A57,$G$122:$K$153,2)
58	90338.91	179.3	19.86	7.395	0.016505	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B58<173,$F$18*(173/B58),$F$18),2)	=((14.7-D58)*144*E58)+F58-G58-H58-I58	=$F$28	=IF(((K58-J58)/(144*E58))>0,((K58-J58)/(144*E58)),0)	=C58-14.7	=VLOOKUP(A58,$G$122:$K$153,2)
59	100338.9	176.8	18.52	6.994	0.01648	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B59<173,$F$18*(173/B59),$F$18),2)	=((14.7-D59)*144*E59)+F59-G59-H59-I59	=$F$28	=IF(((K59-J59)/(144*E59))>0,((K59-J59)/(144*E59)),0)	=C59-14.7	=VLOOKUP(A59,$G$122:$K$153,2)
60	110338.7	174.8	19.2	6.686	0.016470	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B60<173,$F$18*(173/B60),$F$18),2)	=((14.7-D60)*144*E60)+F60-G60-H60-I60	=$F$28	=IF(((K60-J60)/(144*E60))>0,((K60-J60)/(144*E60)),0)	=C60-14.7	=VLOOKUP(A60,$G$122:$K$153,2)
61	120306.5	173.2	18.83	6.447	0.016469	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B61<173,$F$18*(173/B61),$F$18),2)	=((14.7-D61)*144*E61)+F61-G61-H61-I61	=$F$28	=IF(((K61-J61)/(144*E61))>0,((K61-J61)/(144*E61)),0)	=C61-14.7	=VLOOKUP(A61,$G$122:$K$153,2)
62	130302	171.8	18.68	6.245	0.016461	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B62<173,$F$18*(173/B62),$F$18),2)	=((14.7-D62)*144*E62)+F62-G62-H62-I62	=$F$28	=IF(((K62-J62)/(144*E62))>0,((K62-J62)/(144*E62)),0)	=C62-14.7	=VLOOKUP(A62,$G$122:$K$153,2)
63	140302	170.4	18.47	6.048	0.016453	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B63<173,$F$18*(173/B63),$F$18),2)	=((14.7-D63)*144*E63)+F63-G63-H63-I63	=$F$28	=IF(((K63-J63)/(144*E63))>0,((K63-J63)/(144*E63)),0)	=C63-14.7	=VLOOKUP(A63,$G$122:$K$153,2)
64	150302	168.1	18.27	5.87	0.016445	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B64<173,$F$18*(173/B64),$F$18),2)	=((14.7-D64)*144*E64)+F64-G64-H64-I64	=$F$28	=IF(((K64-J64)/(144*E64))>0,((K64-J64)/(144*E64)),0)	=C64-14.7	=VLOOKUP(A64,$G$122:$K$153,2)
65	160302	167.8	18.07	5.696	0.016438	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B65<173,$F$18*(173/B65),$F$18),2)	=((14.7-D65)*144*E65)+F65-G65-H65-I65	=$F$28	=IF(((K65-J65)/(144*E65))>0,((K65-J65)/(144*E65)),0)	=C65-14.7	=VLOOKUP(A65,$G$122:$K$153,2)
66	170302	166.6	17.9	5.539	0.016431	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B66<173,$F$18*(173/B66),$F$18),2)	=((14.7-D66)*144*E66)+F66-G66-H66-I66	=$F$28	=IF(((K66-J66)/(144*E66))>0,((K66-J66)/(144*E66)),0)	=C66-14.7	=VLOOKUP(A66,$G$122:$K$153,2)
67	180302	165.3	17.72	5.374	0.016424	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B67<173,$F$18*(173/B67),$F$18),2)	=((14.7-D67)*144*E67)+F67-G67-H67-I67	=$F$28	=IF(((K67-J67)/(144*E67))>0,((K67-J67)/(144*E67)),0)	=C67-14.7	=VLOOKUP(A67,$G$122:$K$153,2)
68	190302	164.1	17.54	5.225	0.016417	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B68<173,$F$18*(173/B68),$F$18),2)	=((14.7-D68)*144*E68)+F68-G68-H68-I68	=$F$28	=IF(((K68-J68)/(144*E68))>0,((K68-J68)/(144*E68)),0)	=C68-14.7	=VLOOKUP(A68,$G$122:$K$153,2)
69	194052	163.8	17.47	5.164	0.016414	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B69<173,$F$18*(173/B69),$F$18),2)	=((14.7-D69)*144*E69)+F69-G69-H69-I69	=$F$28	=IF(((K69-J69)/(144*E69))>0,((K69-J69)/(144*E69)),0)	=C69-14.7	=VLOOKUP(A69,$G$122:$K$153,2)
70	196682	163.3	17.43	5.127	0.016413	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B70<173,$F$18*(173/B70),$F$18),2)	=((14.7-D70)*144*E70)+F70-G70-H70-I70	=$F$28	=IF(((K70-J70)/(144*E70))>0,((K70-J70)/(144*E70)),0)	=C70-14.7	=VLOOKUP(A70,$G$122:$K$153,2)
71	197802	163.2	17.41	5.115	0.016412	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B71<173,$F$18*(173/B71),$F$18),2)	=((14.7-D71)*144*E71)+F71-G71-H71-I71	=$F$28	=IF(((K71-J71)/(144*E71))>0,((K71-J71)/(144*E71)),0)	=C71-14.7	=VLOOKUP(A71,$G$122:$K$153,2)
72	200302	162.8	17.37	5.079	0.016411	=$F$25	=0.00000025*$F$9^2	=0.38*(($F$9/4000)^2)	=ROUND(IF(B72<173,$F$18*(173/B72),$F$18),2)	=((14.7-D72)*144*E72)+F72-G72-H72-I72	=$F$28	=IF(((K72-J72)/(144*E72))>0,((K72-J72)/(144*E72)),0)	=C72-14.7	=VLOOKUP(A72,$G$122:$K$153,2)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
73														
74	RHR - Long Term (After EPU) 1.5 wt. % Containment Leakage & 100% Spray Efficiency													
75-77	Time (sec)	OE Pool Temp (F)	OE Pool Pressure psia	Pv (psia)	Vf (ft^3/lb)	Z (ft)	hf (ft)	hs (ft)	hd (ft)	RHR NPSHa (ft)	RHR NPSHr (ft)	RHR OPR (psig)	OPA (psig)	OPC (psig)
78	785.6045	169.7	17.71	5.851	0.016446	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B78<173,$C$18*(173/B78),$C$18),2)	=((14.7-D78)*144*E78)+F78-G78+H78-I78	=$C$26	=IF((+K78-J78)/(144*E78)>0,(+K78-J78)/(144*E78),0)	=+C78-14.7	=VLOOKUP(A78,$G$122:$K$153,2)
79	1087.855	171.8	17.94	6.246	0.016461	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B79<173,$C$18*(173/B79),$C$18),2)	=((14.7-D79)*144*E79)+F79-G79+H79-I79	=$C$26	=IF((+K79-J79)/(144*E79)>0,(+K79-J79)/(144*E79),0)	=+C79-14.7	=VLOOKUP(A79,$G$122:$K$153,2)
80	2033.384	175.6	18.57	6.882	0.016486	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B80<173,$C$18*(173/B80),$C$18),2)	=((14.7-D80)*144*E80)+F80-G80+H80-I80	=$C$26	=IF((+K80-J80)/(144*E80)>0,(+K80-J80)/(144*E80),0)	=+C80-14.7	=VLOOKUP(A80,$G$122:$K$153,2)
81	2882.323	180	19.17	7.611	0.016508	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B81<173,$C$18*(173/B81),$C$18),2)	=((14.7-D81)*144*E81)+F81-G81+H81-I81	=$C$26	=IF((+K81-J81)/(144*E81)>0,(+K81-J81)/(144*E81),0)	=+C81-14.7	=VLOOKUP(A81,$G$122:$K$153,2)
82	4198.48	183.4	19.9	8.086	0.01653	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B82<173,$C$18*(173/B82),$C$18),2)	=((14.7-D82)*144*E82)+F82-G82+H82-I82	=$C$26	=IF((+K82-J82)/(144*E82)>0,(+K82-J82)/(144*E82),0)	=+C82-14.7	=VLOOKUP(A82,$G$122:$K$153,2)
83	5125.042	186.2	20.34	8.42	0.016541	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B83<173,$C$18*(173/B83),$C$18),2)	=((14.7-D83)*144*E83)+F83-G83+H83-I83	=$C$26	=IF((+K83-J83)/(144*E83)>0,(+K83-J83)/(144*E83),0)	=+C83-14.7	=VLOOKUP(A83,$G$122:$K$153,2)
84	6275.298	187	20.82	8.798	0.016552	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B84<173,$C$18*(173/B84),$C$18),2)	=((14.7-D84)*144*E84)+F84-G84+H84-I84	=$C$26	=IF((+K84-J84)/(144*E84)>0,(+K84-J84)/(144*E84),0)	=+C84-14.7	=VLOOKUP(A84,$G$122:$K$153,2)
85	8036.636	189.1	21.5	9.181	0.016566	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B85<173,$C$18*(173/B85),$C$18),2)	=((14.7-D85)*144*E85)+F85-G85+H85-I85	=$C$26	=IF((+K85-J85)/(144*E85)>0,(+K85-J85)/(144*E85),0)	=+C85-14.7	=VLOOKUP(A85,$G$122:$K$153,2)
86	10219.89	191	21.88	9.541	0.016578	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B86<173,$C$18*(173/B86),$C$18),2)	=((14.7-D86)*144*E86)+F86-G86+H86-I86	=$C$26	=IF((+K86-J86)/(144*E86)>0,(+K86-J86)/(144*E86),0)	=+C86-14.7	=VLOOKUP(A86,$G$122:$K$153,2)
87	12083.67	192.2	22.06	9.788	0.016585	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B87<173,$C$18*(173/B87),$C$18),2)	=((14.7-D87)*144*E87)+F87-G87+H87-I87	=$C$26	=IF((+K87-J87)/(144*E87)>0,(+K87-J87)/(144*E87),0)	=+C87-14.7	=VLOOKUP(A87,$G$122:$K$153,2)
88	15169.8	193.6	22.31	10.083	0.016594	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B88<173,$C$18*(173/B88),$C$18),2)	=((14.7-D88)*144*E88)+F88-G88+H88-I88	=$C$26	=IF((+K88-J88)/(144*E88)>0,(+K88-J88)/(144*E88),0)	=+C88-14.7	=VLOOKUP(A88,$G$122:$K$153,2)
89	17888.2	194.3	22.43	10.233	0.016599	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B89<173,$C$18*(173/B89),$C$18),2)	=((14.7-D89)*144*E89)+F89-G89+H89-I89	=$C$26	=IF((+K89-J89)/(144*E89)>0,(+K89-J89)/(144*E89),0)	=+C89-14.7	=VLOOKUP(A89,$G$122:$K$153,2)
90	20184.38	194.6	22.46	10.298	0.016601	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B90<173,$C$18*(173/B90),$C$18),2)	=((14.7-D90)*144*E90)+F90-G90+H90-I90	=$C$26	=IF((+K90-J90)/(144*E90)>0,(+K90-J90)/(144*E90),0)	=+C90-14.7	=VLOOKUP(A90,$G$122:$K$153,2)
91	23811.7	194.7	22.48	10.32	0.016601	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B91<173,$C$18*(173/B91),$C$18),2)	=((14.7-D91)*144*E91)+F91-G91+H91-I91	=$C$26	=IF((+K91-J91)/(144*E91)>0,(+K91-J91)/(144*E91),0)	=+C91-14.7	=VLOOKUP(A91,$G$122:$K$153,2)
92	24484.98	194.7	22.48	10.32	0.016601	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B92<173,$C$18*(173/B92),$C$18),2)	=((14.7-D92)*144*E92)+F92-G92+H92-I92	=$C$26	=IF((+K92-J92)/(144*E92)>0,(+K92-J92)/(144*E92),0)	=+C92-14.7	=VLOOKUP(A92,$G$122:$K$153,2)
93	25118.98	194.7	22.47	10.32	0.016601	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B93<173,$C$18*(173/B93),$C$18),2)	=((14.7-D93)*144*E93)+F93-G93+H93-I93	=$C$26	=IF((+K93-J93)/(144*E93)>0,(+K93-J93)/(144*E93),0)	=+C93-14.7	=VLOOKUP(A93,$G$122:$K$153,2)
94	30084.54	194.3	22.42	10.233	0.016599	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B94<173,$C$18*(173/B94),$C$18),2)	=((14.7-D94)*144*E94)+F94-G94+H94-I94	=$C$26	=IF((+K94-J94)/(144*E94)>0,(+K94-J94)/(144*E94),0)	=+C94-14.7	=VLOOKUP(A94,$G$122:$K$153,2)
95	35084.61	193.7	22.33	10.104	0.016596	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B95<173,$C$18*(173/B95),$C$18),2)	=((14.7-D95)*144*E95)+F95-G95+H95-I95	=$C$26	=IF((+K95-J95)/(144*E95)>0,(+K95-J95)/(144*E95),0)	=+C95-14.7	=VLOOKUP(A95,$G$122:$K$153,2)
96	40080.36	192.8	22.2	9.914	0.016589	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B96<173,$C$18*(173/B96),$C$18),2)	=((14.7-D96)*144*E96)+F96-G96+H96-I96	=$C$26	=IF((+K96-J96)/(144*E96)>0,(+K96-J96)/(144*E96),0)	=+C96-14.7	=VLOOKUP(A96,$G$122:$K$153,2)
97	45637.23	191.5	22.01	9.644	0.016581	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B97<173,$C$18*(173/B97),$C$18),2)	=((14.7-D97)*144*E97)+F97-G97+H97-I97	=$C$26	=IF((+K97-J97)/(144*E97)>0,(+K97-J97)/(144*E97),0)	=+C97-14.7	=VLOOKUP(A97,$G$122:$K$153,2)
98	49406.11	190.4	21.79	9.42	0.016574	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B98<173,$C$18*(173/B98),$C$18),2)	=((14.7-D98)*144*E98)+F98-G98+H98-I98	=$C$26	=IF((+K98-J98)/(144*E98)>0,(+K98-J98)/(144*E98),0)	=+C98-14.7	=VLOOKUP(A98,$G$122:$K$153,2)
99	60550.94	187.2	21.21	8.794	0.016554	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B99<173,$C$18*(173/B99),$C$18),2)	=((14.7-D99)*144*E99)+F99-G99+H99-I99	=$C$26	=IF((+K99-J99)/(144*E99)>0,(+K99-J99)/(144*E99),0)	=+C99-14.7	=VLOOKUP(A99,$G$122:$K$153,2)
100	70342.29	184.4	20.72	8.276	0.016536	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B100<173,$C$18*(173/B100),$C$18),2)	=((14.7-D100)*144*E100)+F100-G100+H100-I100	=$C$26	=IF((+K100-J100)/(144*E100)>0,(+K100-J100)/(144*E100),0)	=+C100-14.7	=VLOOKUP(A100,$G$122:$K$153,2)
101	80342.29	181.8	20.26	7.816	0.01652	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B101<173,$C$18*(173/B101),$C$18),2)	=((14.7-D101)*144*E101)+F101-G101+H101-I101	=$C$26	=IF((+K101-J101)/(144*E101)>0,(+K101-J101)/(144*E101),0)	=+C101-14.7	=VLOOKUP(A101,$G$122:$K$153,2)
102	90339.81	179.3	19.88	7.386	0.016506	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B102<173,$C$18*(173/B102),$C$18),2)	=((14.7-D102)*144*E102)+F102-G102+H102-I102	=$C$26	=IF((+K102-J102)/(144*E102)>0,(+K102-J102)/(144*E102),0)	=+C102-14.7	=VLOOKUP(A102,$G$122:$K$153,2)
103	100339.9	176.8	19.52	6.994	0.01649	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B103<173,$C$18*(173/B103),$C$18),2)	=((14.7-D103)*144*E103)+F103-G103+H103-I103	=$C$26	=IF((+K103-J103)/(144*E103)>0,(+K103-J103)/(144*E103),0)	=+C103-14.7	=VLOOKUP(A103,$G$122:$K$153,2)
104	110339.7	174.6	19.2	6.666	0.016478	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B104<173,$C$18*(173/B104),$C$18),2)	=((14.7-D104)*144*E104)+F104-G104+H104-I104	=$C$26	=IF((+K104-J104)/(144*E104)>0,(+K104-J104)/(144*E104),0)	=+C104-14.7	=VLOOKUP(A104,$G$122:$K$153,2)
105	120306.5	173.2	18.93	6.447	0.016469	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B105<173,$C$18*(173/B105),$C$18),2)	=((14.7-D105)*144*E105)+F105-G105+H105-I105	=$C$26	=IF((+K105-J105)/(144*E105)>0,(+K105-J105)/(144*E105),0)	=+C105-14.7	=VLOOKUP(A105,$G$122:$K$153,2)
106	130302	171.8	18.68	6.245	0.016461	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B106<173,$C$18*(173/B106),$C$18),2)	=((14.7-D106)*144*E106)+F106-G106+H106-I106	=$C$26	=IF((+K106-J106)/(144*E106)>0,(+K106-J106)/(144*E106),0)	=+C106-14.7	=VLOOKUP(A106,$G$122:$K$153,2)
107	140302	170.4	18.47	6.048	0.016453	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B107<173,$C$18*(173/B107),$C$18),2)	=((14.7-D107)*144*E107)+F107-G107+H107-I107	=$C$26	=IF((+K107-J107)/(144*E107)>0,(+K107-J107)/(144*E107),0)	=+C107-14.7	=VLOOKUP(A107,$G$122:$K$153,2)
108	150302	169.1	18.27	5.87	0.016446	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B108<173,$C$18*(173/B108),$C$18),2)	=((14.7-D108)*144*E108)+F108-G108+H108-I108	=$C$26	=IF((+K108-J108)/(144*E108)>0,(+K108-J108)/(144*E108),0)	=+C108-14.7	=VLOOKUP(A108,$G$122:$K$153,2)
109	160302	167.8	18.07	5.696	0.016438	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B109<173,$C$18*(173/B109),$C$18),2)	=((14.7-D109)*144*E109)+F109-G109+H109-I109	=$C$26	=IF((+K109-J109)/(144*E109)>0,(+K109-J109)/(144*E109),0)	=+C109-14.7	=VLOOKUP(A109,$G$122:$K$153,2)
110	170302	166.6	17.9	5.539	0.016431	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B110<173,$C$18*(173/B110),$C$18),2)	=((14.7-D110)*144*E110)+F110-G110+H110-I110	=$C$26	=IF((+K110-J110)/(144*E110)>0,(+K110-J110)/(144*E110),0)	=+C110-14.7	=VLOOKUP(A110,$G$122:$K$153,2)
111	180302	165.3	17.72	5.374	0.016424	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B111<173,$C$18*(173/B111),$C$18),2)	=((14.7-D111)*144*E111)+F111-G111+H111-I111	=$C$26	=IF((+K111-J111)/(144*E111)>0,(+K111-J111)/(144*E111),0)	=+C111-14.7	=VLOOKUP(A111,$G$122:$K$153,2)
112	190302	164.1	17.54	5.225	0.016417	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B112<173,$C$18*(173/B112),$C$18),2)	=((14.7-D112)*144*E112)+F112-G112+H112-I112	=$C$26	=IF((+K112-J112)/(144*E112)>0,(+K112-J112)/(144*E112),0)	=+C112-14.7	=VLOOKUP(A112,$G$122:$K$153,2)
113	194052	163.6	17.47	5.164	0.016414	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B113<173,$C$18*(173/B113),$C$18),2)	=((14.7-D113)*144*E113)+F113-G113+H113-I113	=$C$26	=IF((+K113-J113)/(144*E113)>0,(+K113-J113)/(144*E113),0)	=+C113-14.7	=VLOOKUP(A113,$G$122:$K$153,2)
114	196552	163.3	17.43	5.127	0.016413	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B114<173,$C$18*(173/B114),$C$18),2)	=((14.7-D114)*144*E114)+F114-G114+H114-I114	=$C$26	=IF((+K114-J114)/(144*E114)>0,(+K114-J114)/(144*E114),0)	=+C114-14.7	=VLOOKUP(A114,$G$122:$K$153,2)
115	197802	163.2	17.41	5.115	0.016412	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B115<173,$C$18*(173/B115),$C$18),2)	=((14.7-D115)*144*E115)+F115-G115+H115-I115	=$C$26	=IF((+K115-J115)/(144*E115)>0,(+K115-J115)/(144*E115),0)	=+C115-14.7	=VLOOKUP(A115,$G$122:$K$153,2)
116	200302	162.9	17.37	5.079	0.016411	=$C$25	=0.0000000477*$C$8^2	=$C$15	=ROUND(IF(B116<173,$C$18*(173/B116),$C$18),2)	=((14.7-D116)*144*E116)+F116-G116+H116-I116	=$C$26	=IF((+K116-J116)/(144*E116)>0,(+K116-J116)/(144*E116),0)	=+C116-14.7	=VLOOKUP(A116,$G$122:$K$153,2)

VY CALCULATION DATABASE INPUT FORM

Place this form in the calculation package immediately following the Title page or CCN form.

VYC-0808 / 06 — VY Calculation/CCN Number
6 — Revision Number
N/A — Vendor Calculation Number
N/A — Revision Number

Vendor Name: N/A PO Number: N/A

Originating Department: Fluid Systems

Critical References Impacted: ☒ UFSAR ☒ DBD ☐ Reload. "Check" the appropriate box if any critical document is identified in the tables below.

EMPAC Asset/Equipment ID Number(s): P-10-1A/B/C/D, P-46-1A/B

EMPAC Asset/System ID Number(s): 10, 14

Keywords: Residual Heat Removal (RHR), Core Spray (CS), Net Positive Suction Head (NPSH), Loss of Coolant Accident (LOCA), Extended Power Uprate (EPU)

For Revision/CCN only: Are deletions to General References, Design Input Documents or Design Output Documents required? ☐ Yes† ☒ No

Design Input Documents and General References - The following documents provide design input or supporting information to this calculation. (Refer to Appendix A, sections 3.2.7 and section 4)

* Reference #	** DOC #	REV #	***Document Title (including Date, if applicable)	Significant Difference Review ††	**** Affected Program	Critical Reference (✓)
1	GE-VYNPS-AEP-346	1	VYNPS EPU T0400: DBA-LOCA for Long Term NPSH evaluation (7/6/04)			
2	VYC-1924	0	DE&S Calc. DC-A34600-006. Vermont Yankee ECCS Suction Strainer Head Loss Performance Assessment, RHR and CS Debris Head Loss Calculations			
3	VYC-0808 / CCN 03	6	Core Spray and Residual Heat Removal Pump Net Positive Suction Head Margin Following a Loss of Coolant Accident			
4	VYC-0808	6	Core Spray and Residual Heat Removal Pump Net Positive Suction Head Margin Following a Loss of Coolant Accident			
5	ERC-2004-024	N/A	Revised OPL-4 Input for Minimum DW Pressure Case dated 6/8/04			
6			NOT USED			
7			ASME Steam Tables, 1967 IFC Formulation for Industrial Use			
8	ERC No. 2003-027	N/A	Debris Source Terms Appropriate for Power Uprate Evaluations of ECCS NPSH (5/13/03)			
9	RHR	1/IC16	Design Basis Document for Residual Heat Removal System			✓
10	VYC-1924 / CCN 02	0	DE&S Calc. DC-A34600-006. Vermont Yankee ECCS Suction Strainer Head Loss Performance Assessment, RHR and CS Debris Head Loss Calculations			
11	VYC-0808 / CCN 04	6	Core Spray and Residual Heat Removal Pump Net Positive Suction Head Margin Following a Loss of Coolant Accident or Anticipated Transients Without Scram			
12	VYC-0808 / CCN 05	6	Core Spray and Residual Heat Removal Pump Net Positive Suction Head Margin Following a Loss of Coolant Accident or Anticipated Transients Without Scram			

Design Output Documents - This calculation provides output to the following documents. (Refer to Appendix A, section 5)

* Reference #	** DOC #	REV #	Document Title (including Date, if applicable)	**** Affected Program	†††Critical Reference (✓)
12	NEDC-33090P	0	Safety Analysis Report For VYNPS Constant Pressure Power Uprate (PUSAR)		
13	VYC-1628	0	Torus Temperature and Pressure Response to Large Break LOCA and MSLB Accident Scenarios (may be superseded be GE EPU analysis)		
14	SADBD	2/IC2	Topical Design Basis Document for Safety Analysis		✓
15	UFSAR	17	Updated Final Safety Analysis Report		✓
16	RHR	1/IC16	Design Basis Document for Residual Heat Removal System		✓
17	CS	0/IC10	Design Basis Document for Core Spray System		✓

* Reference # - Assigned by preparer to identify the reference in the body of the calculation.

** Doc # - Identifying number on the document, if any (e.g., 5920-0264, G191172, VYC-1286)

*** Document Title - List the specific documentation in this column. "See attached list" is not acceptable. Design Input/Output Documents should identify the specific design input document used in the calculation or the specific document affected by the calculation and not simply reference the document (e.g., VYDC, MM) that the calculation was written to support. If a DBD is used as a general reference, include the most current interim change number after the title.

**** Affected Program - List the affected program or the program that reference is related to or part of.

† If "yes," attach a copy of "VY Calculation Data" marked-up to reflect deletion (See Section 3.1.8 for Revision and 5.2.3.18 for CCNs).

†† If the listed input is a calculation listed in the calculation database that is not a calculation of record (see definition), place a check mark in this space to indicate completion of the required significant difference review. (see Appendix A, section 4.1.4.4.3). Otherwise, enter "N/A."

††† If the reference is UFSAR, DBD or Reload (IASD or OPL), check Critical Reference column and check UFSAR, DBD or Reload, as appropriate, on this form (above).